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## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

## ANNUAL METRICATION REPORT TO THE CONGRESS

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Overview

NASA's principal metrication accomplishments for FY 1990 were establishment of a metrication policy for major programs, development of an implementing instruction for overall metric policy and initiation of metrication planning for the major program offices. In FY 1991, development of an overall NASA plan and individual program office plans will be completed, requirement assessments will be performed for all support areas, and detailed assessment and transition planning will be undertaken at the institutional level. Metric feasibility decisions on a number of major programs are expected over the next 18 months. --

FY 1990 ACTIVITIESPolicy Development

In June of 1990, the Deputy Administrator of NASA issued a policy letter requiring use of the metric system of measurement, unless specifically waived, for all major flight programs entering Phase C/D (final design and development) after October 1, 1990. Although recognizing that some exceptions will be necessary, particularly in the near term, the policy clearly establishes the metric system as the preferred system of units for NASA programs. The policy also calls for positive steps to assure support of new metric hardware by existing systems, recognizing that many of NASA's current capital assets, such as the Space Shuttle were built and must be maintained using the inch pound system.

A metric policy implementing instruction has been developed that mandates the development of an integrated NASA transition plan and establishes responsibilities for support of metric transition by the NASA program offices and field installations. Reviews of that instruction have been completed. The NASA Metrication Planning Group, a Headquarters committee established for metric policy development and transition coordination, continues to serve as the focus for both policy development and coordination of planning.

NASA also continued active support of the Inter-Agency Committee on Metric Policy through participation in the Metri-

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Operating Committee (MOC) and membership on the steering group for that committee. MOC activities in which NASA participated include revision of Federal metric policy, planning for overall coordination of Federal metric transition, and representation in sub-committees of the MOC.

### Planning and Program Evaluation

The overall pace of metric transition in NASA will depend on the rate at which the metric system of measurement is adopted by major flight programs. Program office requirements will, in turn, define the scope and required timing of functional support. Following establishment of the overall NASA metric policy for new flight programs, detailed assessment and planning activities were initiated by the principal program offices.

In September, 1990, the Office of Space Science and Applications issued a metric policy and approved a preliminary metric transition plan. The plan is based on an assessment of all programs now underway and projected for launch through the year 2010, and establishes a proposed measurement system guideline for each. Although inch-pound based hardware will continue to be launched until for several years, reflecting payloads already under development, derivatives of current payloads, or maintenance of current payloads, the proposed plan foresees a rapid increase of potential metric payloads. Full transition could be effectively completed shortly after the year 2000.

Specific guidelines were established for the Earth Observing System. Because Phase C/D development efforts began last year, a decision was made to retain inch-pound units for the initial (and optional second) spacecraft already in design, but to baseline use of the metric system for any second generation spacecraft. The metric system has been proposed as the baseline for all EOS instruments, and requests for proposals were issued with that guideline. Use of the metric system was also baselined in Requests for Proposals for a number of other programs.

Development of transition plans was initiated in FY 1990 by the other major NASA program offices, namely, the Office of Space Flight, the Office of Exploration and Space Technology and the Office of Operations. In each case, establishment of a long term plan is complicated by such factors as (a) existing commitments to major inch-pound capital assets, such as the Space Shuttle and the Space Station, (b) prevailing use of the inch-pound system by the community using the technology (e.g. commercial aviation) or (c) sources of supply for commercial items for which NASA requirements are not unique nor is NASA a dominating customer (e.g. facility construction or ground support equipment).

Wherever a change to use of the metric system of measurement is made, support will be required in a number of functional areas such as metrology, training, and conversion of standards, and in augmentation of institutional capabilities. During FY 1990, transition planning was initiated in the area of metrology, and by several of the NASA field centers.

An assessment of current metric measurement capability was performed under the auspices of the NASA Metrology Working Group, an existing group charged with coordination and improvement of measurement capabilities throughout NASA. The assessment found hard metric capabilities available in varying degrees at all NASA installations; it was generally available for quantities where electronic readouts are common (e.g. for electrical parameters, pressure, and temperature measurements) and less available for mechanical measurements (size, and shape). Preliminary estimates of transition costs were developed for integration into the overall NASA plan.

Initial planning was also started in the areas of supply/logistics and facility construction. Although the initial conclusion in each of these areas was that substantial progress was required in existing commercial areas before action could be taken, there has been some definition of requirements for incorporating transition once external capability is available.

Metric planning at the institutional level includes establishment of metric planning committees at three NASA installations. A survey of metric capabilities already on hand was found to be considerable in design areas (largely because of computer-based analysis tools) and in fabrication areas (ranging from 30% to 60% of current capacity). This capability has generally not been used due to requirements for inch-pound by the programs.

NASA has continued to actively support interagency metric programs through the Interagency Committee on Metric Policy. Subcommittees activities of the MOC supported during the year include the Construction sub-committee (plan development and issue assessment), the Metric Practices committee (proposed revision of FED-STD 376A) and the Education and Training committee (needs survey). NASA also participated in development of proposed language for the Federal Acquisition Regulations to assure proper consideration of metric usage in acquisition planning.

#### Supporting Activities

NASA provided information for a survey of Federal metric activities by the Government Accounting Office in the fall of 1989. On April 24, 1990, NASA presented testimony on its metric activities in hearings before the Subcommittee on

Science, Research and Technology of the Committee on Science, Space and Technology of the House of Representatives. That testimony did include preliminary targets for NASA's metric transition planning activity, namely:

- Establishment of NASA metric policy: Late 1990
- Definition of supporting requirements: Late 1991
- Establishment of Program Office metric transition targets: Mid 1992
- Establishment of a target for completing transition: Late 1992

Issuance of the policy letter referred to above, requiring use of the metric system for major programs substantially met NASA's first metric transition target. The development of program office plans, institutional capability assessments and functional support planning also described above suggest that we may be ahead of schedule for meeting the other targets.

One clear change from last year is that manpower addressing the metric issue has increased substantially during the past year. What is significant is not the actual hours spent, but rather the breadth of involvement across NASA, both in number of people and the variety of programs in which the issue is under active consideration. Although such dispersed activity makes it difficult to establish the level of effort, we believe that effective transition will depend more on part time involvement of many, rather than full time involvement of a few individuals.

Availability of space qualified metric piece parts was identified as a critical impediment to metrication by a study performed last year. A project to address this issue for one class of parts (fasteners) was developed and discussed with industry and government representatives. Implementation has been delayed to allow the project to be tied to a specific metric development project to insure its relevance.

Existing standards for metric conversion factors and metric practice were evaluated as a basis for deciding whether or not to update an existing NASA document. The decision was to cancel the NASA document (NASA SP 7012) and rely on existing non-government standards such as that published by the American National Standards Institute (ANSI).

Experience with hybrid systems was examined to provide a basis for more detailed guidelines in that area. The focus of this evaluation was the Spacelab system, flown in the inch pound based Space Shuttle, but developed using the metric system of measurement. The results and recommendations will be used in an expanded metric practice development activity planned for the coming year.

Toward the end of the calendar year, a video conference was held with all of the NASA field installations to bring them up

to date on metric developments, Headquarters planning and issues affecting institutional planning. Video conferences are a particularly effective mechanism for maintaining communications among the field installations and will be continued to keep them informed on progress and to promote mutual reinforcement of metric experience.

#### PLANNED FY 1991 ACTIVITIES

Detailed instructions implementing the metric policy letter of June 1990 will be issued and will be incorporated in guidance at the operating level. Additional policies that may be required within specific NASA programs will be developed in conjunction with program office plans.

Plans will be developed for the remaining program offices, identifying the projected runout of inch pound based programs and opportunities for introduction of the metric system. These plans will be integrated with functional support plans into an overall NASA transition plan that will provide the targets against which detailed transition targets can be developed.

During the coming year, industry responses to the first requests for metric hardware systems will provide indications of industry's readiness to support metric transition. These responses should be helpful in both identifying specific barriers to use of the metric system and in refining the projections of preliminary program plans.

Planning at the institutional level will be expanded, both to complete assessments of existing metric capability at NASA field installations and to define schedules and requirements for transition. In all cases, emphasis will be placed on accommodating requirements within normal improvement replacement planning. The need to maintain dual measurement system support capabilities for some time to come is expected to be a significant issue and will receive attention as detailed requirements are defined.

Assessment and planning for all functional areas in will be performed in FY 1991 and will be targeted toward defining needs and schedule requirements by the end of FY 1991.